

## **CORRELATES OF STUDIES ON HELMINTHOSPORIUM BLIGHT OF MAIZE WITH SPECIAL REFERENCE TO MANAGEMENT FOR ODISHA CONDITION**

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### **ABSTRACT**

Globally, maize is known as “queen of cereals” because of its highest genetic yield potentiality among the cereals. India ranks sixth in global maize production, contributing to 2.4% of world production with almost 5% share in world harvested area. Importance of outbreak of different diseases on this crop are of the major constraints of its low productivity, that has been felt seriously and leaf blight disease caused by *Helminthosporium maydis* is of wide spread occurrence in the country as well as in the state of Odisha. Therefore, it was felt desirable to undertake the present investigation. An in depth study was undertaken in Bhubaneswar and Bargarh area where incidence was found in a range from 29.0-34.5%. The symptomatological result revealed that, leaf blight symptoms initially found as water soaked, yellowish, discoloured, diamond shaped lesions restricted by veins. Later on it elongated giving rectangular appearance with reddish brown borders and finally diffuses with marginal chlorosis leading to collapse of leaf. The pathogenicity of the fungus *Helminthosporium maydis* tested on potted maize plants and isolated fungus was found identical to the earlier one. The growth of fungus was found best in Host extract agar medium (89mm) followed by Richard's agar (88mm). Different carbon sources tested, maximum growth was obtained in medium supplemented with sucrose followed by glucose, dextrose and lactose. Neutral range ( $P^H$  7.0) was the best for the growth of the fungus. All meteorological parameters (Maximum and Minimum Temperature, Maximum and Minimum RH, Rainfall, Number of rainy days, Wind velocity, Bright sunshine hours and Evaporation) contributed 76.8% towards disease development. However the parameters like Maximum RH, Rainfall and Bright sunshine hours were found to be statistically significant. Garlic was proved to be the most effective at 10% followed by Cochila where as both garlic and onion gave complete inhibition at 20% concentration followed by Cochila. Among the bioagents, highest percentage of growth inhibition was found in *Bacillus subtilis* followed by *Trichoderma viride* and *T. harzianum*. In vitro evaluation of fungicides against *Helminthosporium maydis* showed maximum inhibition by Cymoxanil 8% WP+ Mancozeb 64%WP followed by Mancozeb 63% WP + Carbendazim 12% WP. Screening of varieties against test fungus showed NK30, CORN 6217, SMART-G 8 and ASMH-777 as resistant where as Vivek hyb-9 and Vivek QPM were reported highly susceptible.

**KEYWORDS:** Correlates of Studies on *Helminthosporium* Blight of Maize with Special Reference to Management, Maize (*Zea mays* L.)

### **INTRODUCTION**

Maize (*Zea mays* L.) is one of the oldest cereals which has been under cultivation for thousand of years. It is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Globally, maize is

known as 'queen of cereals' because it has the highest genetic yield potentiality among the cereals. It has been reported that, the cultivated form of maize was derived by mutation from a wild form of pod maize indigenous to the eastern slopes of Andus in south America which is thought to be the place of its origin (Mangelsdorf, 1947). It was introduced to India by Portuguese at about the beginning of the 17<sup>th</sup> century. Now it is one of the important cereals in India. Maize belongs to the tribe Maydeae of the grass family *Poaceae*. "Zea" (zela) was derived from an old Greek name for a food grass.

Maize ranks first in world production (868 million tons from 168 million hectares) followed by wheat (691 million tons) and rice (461 million tons). This represents 38% of the total grain production as compared to 30 % for wheat and 20% for rice. Maize is a very important cereal in many developed and developing countries of the world. Among the cereal crops in India, Maize with annual production of around 21 million tones covering 8.5 million hectares ranks third in production. India ranks sixth in global maize production, contributing to 2.4% of world production with almost 5% share in world harvested area. However, the country lags far behind in productivity of 24.7 q/ha against world average of 51.4 q/ha (India Maize Summit, 2013).

In India, maize contributes nearly 9 % in the national food basket and more than Rs. 100 billion to the agricultural GDP at current prices apart from the generating employment to over 100 million man-days at the farm and downstream agricultural and industrial sectors.

Nevertheless, the importance of outbreak of different diseases on this crop are of the major constraints for its low productivity, that has been felt seriously and as leaf blight disease caused by *Helminthosporium maydis* is of wide spread occurrence in the country and in the state of Odisha also. Therefore, it was felt desirable to undertake the present investigation which includes some of the morphological, physiological studies of the pathogen, varietal reactions and evaluation of fungicides & some indigenous plant products for control of the disease and some aspects of studies towards its biological control. Hence the present investigation was undertaken with the following objectives:

- Collection of diseased samples from different maize growing areas of Odisha.
- Isolation of pathogen from infected samples and pure culturing.
- Proving pathogenicity.
- Studies on pathogen morphology, effect of different culture media and sporulation of the test pathogen.
- Effect of weather parameters on disease incidence
- Integrated disease management strategies through novel fungicides, botanicals and bio-agents.
- Screening of maize germplasm / variety against disease resistance.

## REVIEW OF LITERATURE

Helminthosporium leaf blight & leaf spot caused by five distinct species viz. *Helminthosporium maydis* Nishik & Miyk, 1926(=*Cochliobolus heterostrophus* (Drechs)), *H. turcicum* Pass(=*Setosphaeria turcica* (Luttrell) Leonard and Suggs), *H. carbonum* Nelson, *H. rostratum* Prechsl & *H. tetramera* Mc.kinney (Sangam Lal, 1990).

Out of which southern corn leaf blight caused by *Bipolaris maydis* (Nisik.) Shoemaker, *Helminthosporium maydis* Nisik. (Syn. *Drechslera maydis* (Nisik.) Subram. & Jain), teleomorph *Cochliobolus heterostrophus* (Drechs) and northern

corn leaf blight caused by *Exserohilum turcicum* (Pass.) Leonard and Suggs, *Bipolaris turcica* (Pass.) Shoemaker, *Drechslera turcica* (Pass) (Subram and Jain) Teleomorph *Trichometasphaeria turcica* Luttrell, (Syn. *Setosphaeria turcica* (Luttrell) Leonard and Suggs) causing huge loss in corn production,

## MATERIALS AND METHODS

The Helminthosporium blight of maize is a wide spread disease in Odisha causing huge economic loss. Considering the importance of the disease, research work has been undertaken to study the pathogen and its management through application of botanicals, bio agents and chemicals.

The present investigation was carried out both in the laboratory and field during 2012- 14. The field experiment was conducted at the Central farm, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar and Research field of Department of plant pathology, OUAT, Bhubaneswar while the laboratory experiments were carried out in the Department of Plant Pathology, College of Agriculture, Bhubaneswar.

The details of materials used and the methodology followed in conducting the experiments are described in this chapter.

## DISCUSSIONS

Maize suffers from about 110 diseases on global basis. The importance of outbreak of different diseases on this crop is of the major constraints of its low productivity. A large number of pathogens have been reported in maize inducing foliar, stalk root, root rot and ear rot diseases. Under favourable climatic condition, diseases occur in alarming proportions causing deterioration in yield and quality of cobs. In the present investigation, Helminthosporium blight caused by *Helminthosporium maydis* was observed in and around Bhubaneswar was studied with various aspects like isolation, identification and proving pathogenicity of pathogen, cultural and morphological characteristics, epidemiology, management practices including phytoextracts, bioagents, chemicals *in vitro* and varietal screening *in vivo*.

An extensive survey was carried out during *kharif* 2013-14 in maize fields of different parts of Odisha and found that the Helminthosporium blight incidence ranged from 29.0% to 34.5% which supported findings of Panda (1996); Sharma and Lal(1998). CAB International (2003) states that, *Helminthosporium maydis* is of wide spread occurrence in maize-growing regions of the country including the state of Odisha.

The lesions on the leaves developed at first as water soaked, yellowish, discoloured, diamond shaped or elliptical spots of 2.5×1-2mm mainly on the younger and middle leaves restricted by the veins. Later it was elongated giving rectangular appearance. The older lesions on leaves showed tan, parallel straight sided with buff or reddish-brown borders. The lesions also found on sheaths, stalks, ears and cobs. The lesions were diffuse with marginal chlorosis leading to collapse of leaf which supported the descriptions given by CAB International (1971).

The fungus associated in the diseased leaf was examined for its morphological features. The conidia were found curved, fusiform, pale to mid dark brown, tapering to round ends, 5-10 pseudoseptate measuring 38.52-90.9µm×9.77-17.19µm with mean dimension of 68.69×14.26µm. Conidiophores were solitary or in groups emerging from dark brown to black stromata, straight or flexuous, sometimes geniculate, mid to dark brown, pale near apex and smooth. Such findings are also in agreement with the findings of Vinh and sarbhoy (1991).

On pathogenicity test, the causal fungus could induce typical symptom on test plant after one week of artificial

inoculation where as the plant without inoculation did not exhibit any symptom. This finding was in conformity with the findings of Naaz *et. al.* (2011) the pathogen isolated from the diseased samples and after pathogenicity test the fungus was found similar from both the cases and identified as *Helminthosporium maydis*.

Twenty one new varieties were screened against *Helminthosporium maydis*. Out of which NK30, CORN 6217, SMART-G 8, ASMH-777 were found be resistant, ASMH-333. DMH-7705, MM-1107, HISHELL, IJ-8533 were moderately resistant where as Vivek hyb-9 and Vivek QPM were highly susceptible to *Helminthosporium maydis*.

Therefore, the resistant varieties may be recommended to the farmers of Odisha in maydis blight endemic areas and also these varieties may be exploited in breeding programmes to evolve new varieties possessing disease resistance and suitable agronomic characters.

In order to obtain adequate knowledge of the pathogen concerning growth characteristics, it was grown on a variety of solid media. The data presented earlier have shown that the causal organism (*Helminthosporium maydis*) exhibited most superior growth in Host extract agar medium(89mm) followed by Richard's agar(88mm), Potato dextrose agar(85.75mm) and Czapek's Dox agar (80.75) media whereas least growth was recorded in case of Sabouraud dextrose agar(75.75) medium. Among different carbon sources maximum growth was obtained in medium substituted with sucrose followed by glucose, lactose and dextrose. It supports the results given by various workers Misra and Roy (1965), Tripathi (2006), Kumar and Dubey (2007), Kumar and Rani (2008) and Naz *et. al.* (2011)

## SUMMARY AND CONCLUSIONS

Keeping in view the outline of objectives, studies on *Helminthosporium* blight of maize caused by *Helminthosporium maydis* were conducted during 2013-14. An extensive survey was carried out during *kharif* 2013-14 in maize fields of experimental field, Department of Plant Pathology, Central farm, OUAT, Bhubaneswar and farmer's field at Bargarh and found that the *Helminthosporium* blight incidence ranged from 29.0% to 34.5%. Diseased leaf samples were collected and analysed for disease causing agents following standard procedure, microscopically detected and brought into pure culture for further study.

The *in vitro* study of twelve fungicides against *Helminthosporium maydis* revealed that, Cymoxanil 8% WP+ Mancozeb 64%WP gave maximum inhibition followed by Mancozeb 63% WP + Carbendazim 12% WP.

Among Twenty one new varieties screened against test fungus, NK30, CORN 6217, SMART-G 8, ASMH-777 were found resistant where as Vivek hyb-9 and Vivek QPM were highly susceptible to *Helminthosporium maydis*.

Therefore, the resistant varieties may be recommended to the farmers of Odisha in maydis blight endemic areas and also these varieties may be exploited in breeding programmes to evolve new varieties possessing disease resistance and suitable agronomic characters.

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## APPENDICES



Figure 1: Maize Plants in Inoculation Mode

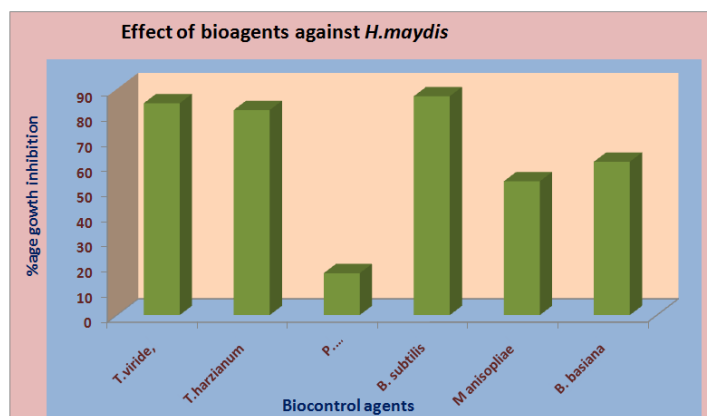


Figure 2: Inoculation of *Helminthosporium* Spp



Figure 3